In [38]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [39]:

```
train = pd.read_csv("train.csv")
test = pd.read_csv("test.csv")
test_2 = pd.read_csv("test.csv")
```

In [40]:

```
train.describe()
```

Out[40]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	223.500000	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

處理 missing data

In [41]:

```
print(train.isnull().sum())
print(train.info())
```

```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
Age            177
SibSp            0
Parch            0
Ticket           0
Fare             0
Cabin          687
Embarked         2
dtype: int64
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  891 non-null    int64
 1   Survived     891 non-null    int64
 2   Pclass       891 non-null    int64
 3   Name         891 non-null    object
 4   Sex          891 non-null    object
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64
 7   Parch        891 non-null    int64
 8   Ticket       891 non-null    object
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object
 11  Embarked     889 non-null    object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
None
```

In [42]:

```
print(test.isnull().sum())
print(test.info())
```

```
PassengerId      0
Pclass           0
Name             0
Sex              0
Age             86
SibSp            0
Parch            0
Ticket           0
Fare             1
Cabin          327
Embarked         0
dtype: int64
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 11 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  418 non-null    int64
 1   Pclass       418 non-null    int64
 2   Name         418 non-null    object
 3   Sex          418 non-null    object
 4   Age          332 non-null    float64
 5   SibSp        418 non-null    int64
 6   Parch        418 non-null    int64
 7   Ticket       418 non-null    object
 8   Fare         417 non-null    float64
 9   Cabin        91 non-null     object
 10  Embarked     418 non-null    object
dtypes: float64(2), int64(4), object(5)
memory usage: 36.0+ KB
None
```

1. train 資料缺"Age", "Cabin", "Embarked"
2. test 資料缺"Age", "Cabin", "Fare"

處理"Age" 的 missing data

In [43]:

```
# 建立一個"Age"的標準差平均隨機數字的array
data = [train, test, test_2]

for dataset in data:
    mean = train["Age"].mean()
    std = test["Age"].std()
    is_null = dataset["Age"].isnull().sum()
    # 介在平均、標準差、遺失值的隨機數字
    rand_age = np.random.randint(mean - std, mean + std, size = is_null)
    # 填隨機數字
    age_slice = dataset["Age"].copy()
    age_slice[np.isnan(age_slice)] = rand_age
    dataset["Age"] = age_slice
    dataset["Age"] = train["Age"].astype(int)
train["Age"].isnull().sum()
```

Out[43]:

```
0
```

處理 "Embarked" 的 missing data

In [44]:

```
# 用 common value 補
common_value = 'S'
data = [train, test, test_2]

for dataset in data:
    dataset['Embarked'] = dataset['Embarked'].fillna(common_value)
```

處理 "Cabin" 的 missing data

In [45]:

```
# 因為缺太多，所以直接拿掉
train = train.drop(['Cabin'], axis=1)
test = test.drop(['Cabin'], axis=1)
test_2 = test_2.drop(['Cabin'], axis=1)
```

處理 "Fare" 的 missing data

In [46]:

```
data = [train, test, test_2]

for dataset in data:
    dataset['Fare'] = dataset['Fare'].fillna(0)
    dataset['Fare'] = dataset['Fare'].astype(int)
```

In [47]:

```
# 用 common value 補
common_value = 'S'
data = [train, test, test_2]

for dataset in data:
    dataset['Fare'] = dataset['Fare'].fillna(common_value)
```

把不會用到的column拿掉

In [48]:

```
train = train.drop(['PassengerId','Name','Ticket'], axis=1)
test = test.drop(['PassengerId','Name','Ticket'], axis=1)
test_2= test_2.drop(['Name','Ticket'], axis=1)
```

In [49]:

```
genders = {"male": 0, "female": 1}
data = [train, test,test_2]

for dataset in data:
    dataset['Sex'] = dataset['Sex'].map(genders)
```

In [50]:

```
ports = {"S": 0, "C": 1, "Q": 2}
data = [train, test,test_2]

for dataset in data:
    dataset['Embarked'] = dataset['Embarked'].map(ports)
```

In [51]:

```
train.info()
test.info()
test_2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 8 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   Survived  891 non-null    int64
 1   Pclass    891 non-null    int64
 2   Sex       891 non-null    int64
 3   Age       891 non-null    int64
 4   SibSp     891 non-null    int64
 5   Parch     891 non-null    int64
 6   Fare      891 non-null    int64
 7   Embarked  891 non-null    int64
dtypes: int64(8)
memory usage: 55.8 KB
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   Pclass    418 non-null    int64
 1   Sex       418 non-null    int64
 2   Age       418 non-null    int64
 3   SibSp     418 non-null    int64
 4   Parch     418 non-null    int64
 5   Fare      418 non-null    int64
 6   Embarked  418 non-null    int64
dtypes: int64(7)
memory usage: 23.0 KB
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 8 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  418 non-null    int64
 1   Pclass       418 non-null    int64
 2   Sex          418 non-null    int64
 3   Age          418 non-null    int64
 4   SibSp        418 non-null    int64
 5   Parch        418 non-null    int64
 6   Fare         418 non-null    int64
 7   Embarked     418 non-null    int64
dtypes: int64(8)
memory usage: 26.2 KB
```

In [52]:

```
surv = train[train['Survived']==1]
nosurv = train[train['Survived']==0]

print("Survived: %i (%.1f percent), Not Survived: %i (%.1f percent), Total: %i"\
      %(len(surv), 1.*len(surv)/len(train)*100.0,\
        len(nosurv), 1.*len(nosurv)/len(train)*100.0, len(train)))
```

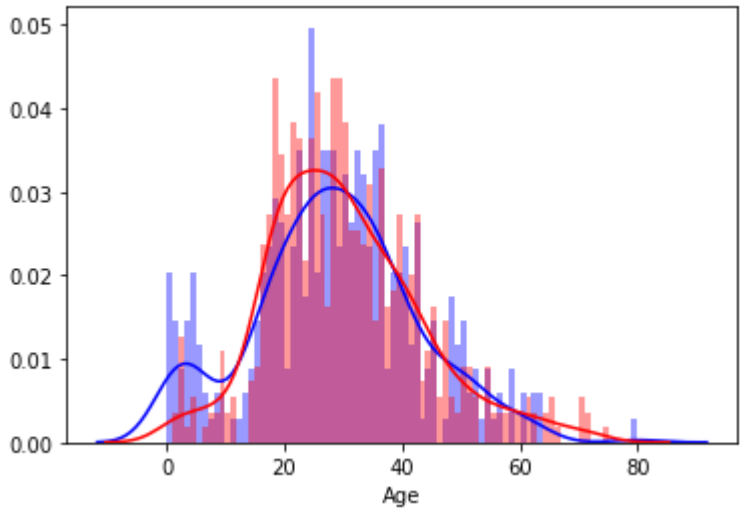
```
Survived: 342 (38.4 percent), Not Survived: 549 (61.6 percent), Total:
891
```

In [53]:

```
sns.distplot(surv['Age'].dropna().values, bins=range(0, 81, 1), color = "blue", axla
sns.distplot(nosurv['Age'].dropna().values, bins=range(0, 81, 1), color = "red", axl
```

Out[53]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd160c792d0>
```



In [54]:

```
median_age_surv = np.median(surv['Age'].dropna())
median_age_nonsurv = np.median(nosurv['Age'].dropna())
print("Median age survivors:", median_age_surv, ", Median age non-survivers:", media
```

```
Median age survivors: 28.0 , Median age non-survivers: 29.0
```

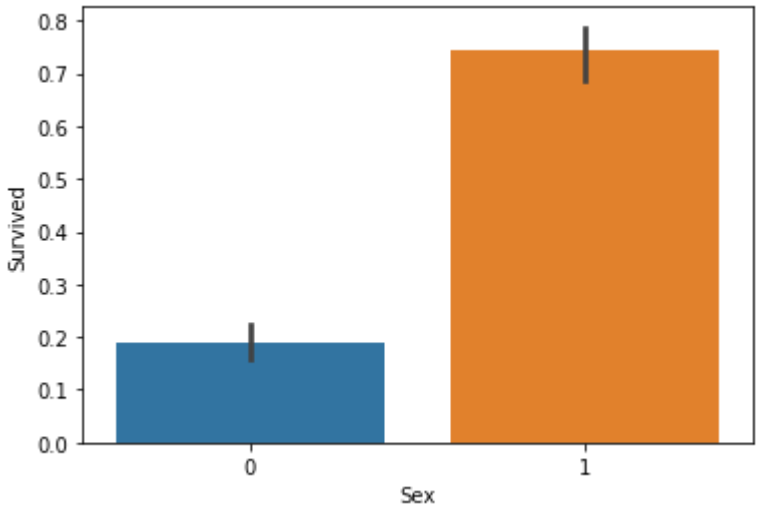
"Age" 中，存活的中位數為28，在0~10歲左右的小孩存活率也較高，在30歲之後的分佈接近常態分佈。 死亡的中位數為28，整體分佈情形近似於常態分佈。

In [55]:

```
sns.barplot('Sex', 'Survived', data=train)
```

Out[55]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd1604262d0>
```



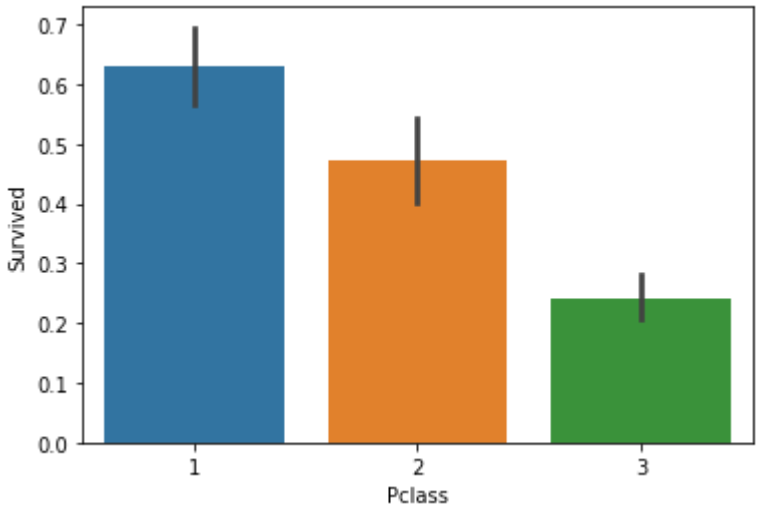
"Sex" 出現 女性存活率 >> 男性存活率

In [56]:

```
sns.barplot('Pclass', 'Survived', data=train)
```

Out[56]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd16049d6d0>
```



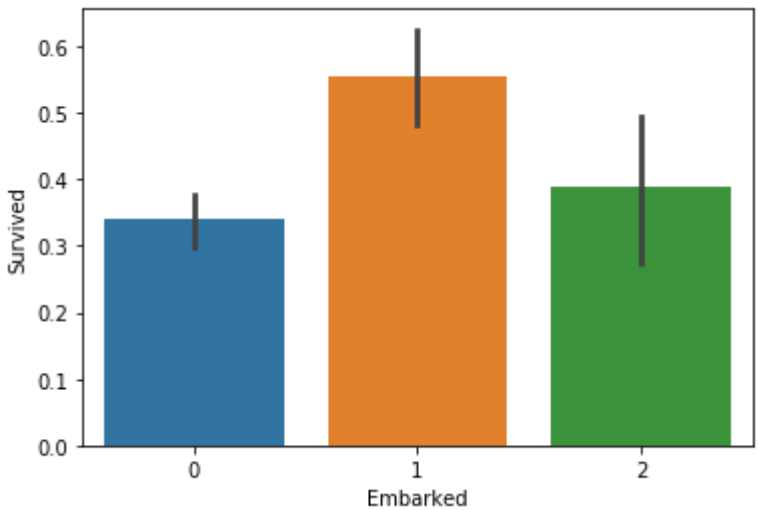
"Pclass"表示3個等級的座位，由高到低1->3，圖中顯示高級座位區的存活率 > 次級座位區的存活率 > 最低等級座位區的存活率

In [57]:

```
sns.barplot('Embarked', 'Survived', data=train)
```

Out[57]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd160500090>
```



"Embarked"表示出發的港口代號，雖然乍看之下跟存活率好像沒什麼關係，但從圖會發現"C港口的存活率" > " S港口的存活率"

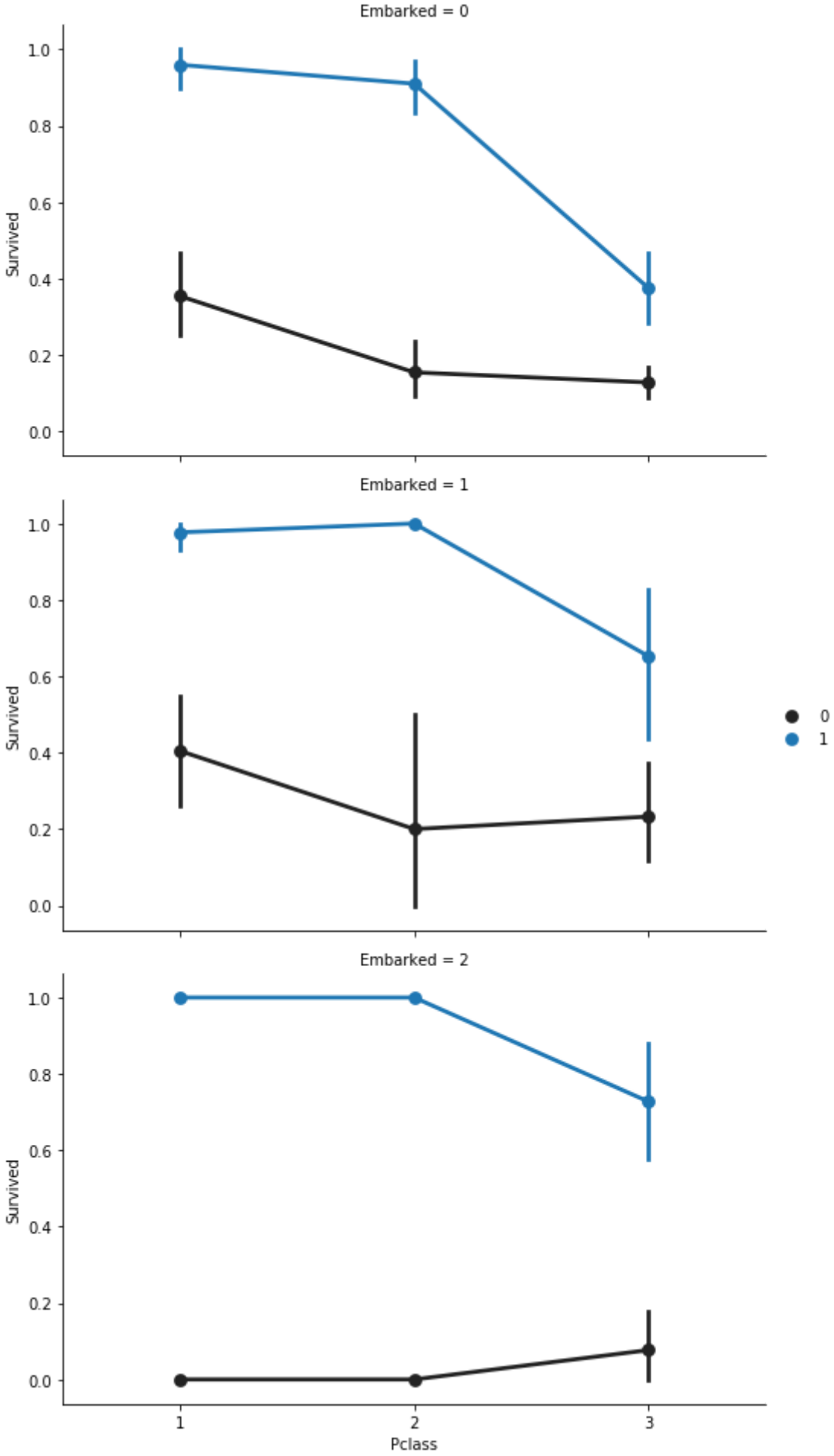
In [58]:

```
FacetGrid = sns.FacetGrid(train, row='Embarked', size=4.5, aspect=1.6)
FacetGrid.map(sns.pointplot, 'Pclass', 'Survived', 'Sex', palette=None,  order=None,
FacetGrid.add_legend()
```

```
/Users/lnl/opt/anaconda3/lib/python3.7/site-packages/seaborn/axisgrid.
py:243: UserWarning: The `size` parameter has been renamed to `height
`; please update your code.
  warnings.warn(msg, UserWarning)
```

Out[58]:

```
<seaborn.axisgrid.FacetGrid at 0x7fd1605e64d0>
```

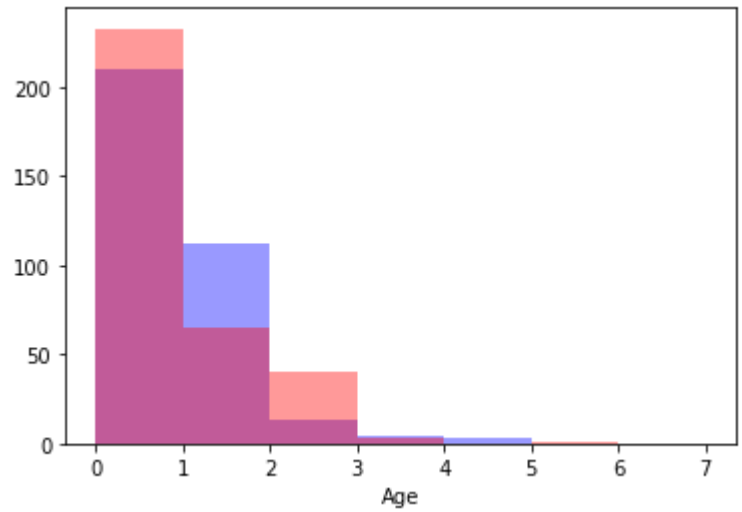

Embarked = 0
Embarked = 1
Embarked = 2
Survived
1.0
0.8
0.6
0.4
0.2
0.0
0
1
1
2
3
Pclass

In [59]:

```
sns.distplot(surv['SibSp'].dropna().values, bins=range(0, 8, 1), kde=False,color = "
sns.distplot(surv['Parch'].dropna().values, bins=range(0, 8, 1), kde=False,color = "
```

Out[59]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd1605e6850>
```



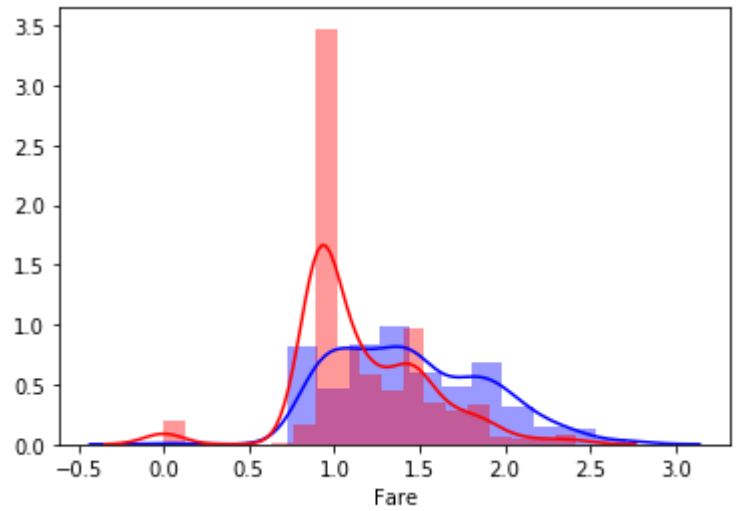
"SibSp"表示有幾個兄弟姊妹或配偶一同旅行，"Parch"表示有幾個爸媽或小孩一同旅行。從圖中可以看出有1~3個家人一起存活的機率比較高。

In [60]:

```
sns.distplot(np.log10(surv['Fare'].dropna().values+1), color = "blue", axlabel='Fare
sns.distplot(np.log10(nosurv['Fare'].dropna().values+1), color = "red", axlabel='Far
```

Out[60]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd160e8f950>
```

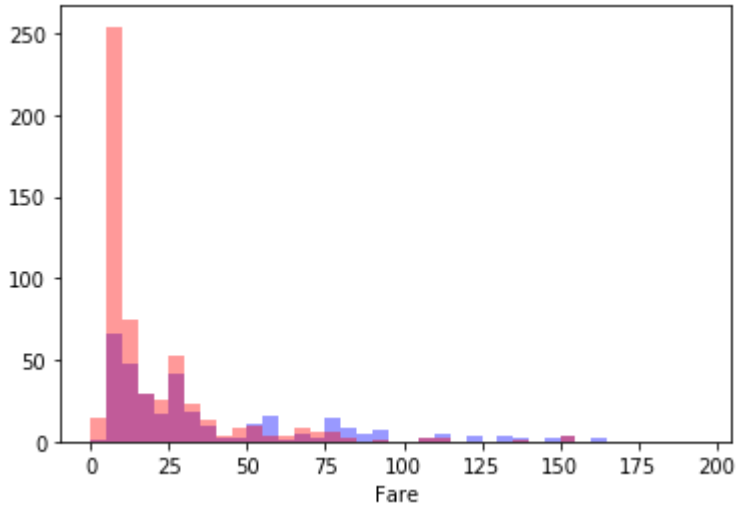


In [61]:

```
sns.distplot(surv['Fare'].dropna().values, bins=range(0, 200, 5), kde=False, color =
sns.distplot(nosurv['Fare'].dropna().values, bins=range(0, 200, 5), kde=False, color
```

Out[61]:

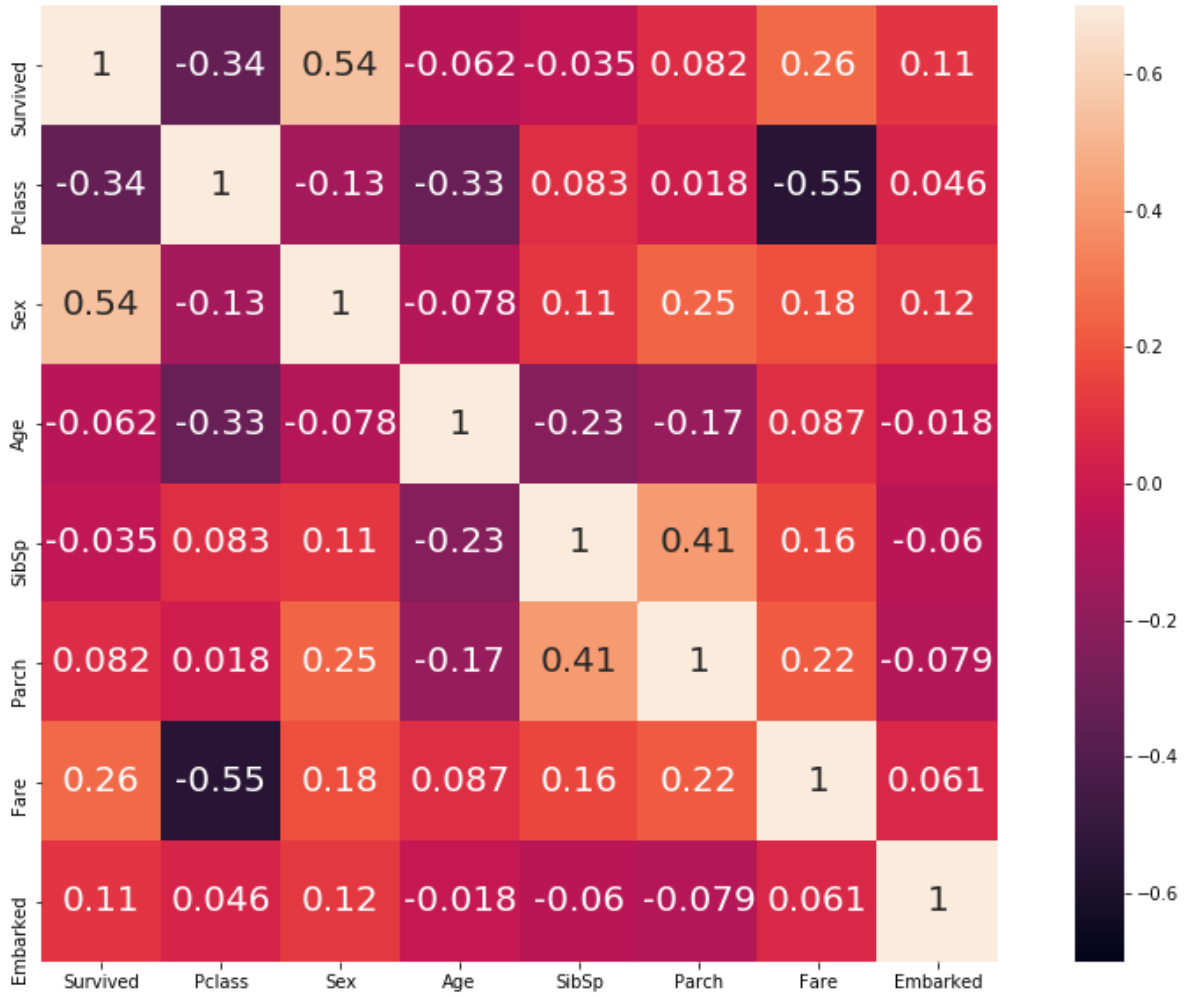
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd160dd0a90>
```



"Fare"表示票價，看似與存活率沒關係，但票價偏低的人死亡率卻異常的高。合理的猜測可能是，票價越低的位子越深處，離救生船比較遠，因此死亡率比較高。

In [62]:

```
plt.figure(figsize=(16,10))
foo = sns.heatmap(train.corr(), vmax=0.7,vmin=-0.7, square=True, annot=True,annot_kw
```



從相關圖可以看出：

1. "Pclass" 跟 "Fare" 相關係數為-0.55，為中度負相關。非常合理，因為高等級座位(class1)票價較高。
2. "SibSp" 和 "Parch" 相關係數為0.41，為中度正相關，推測因為較多人的家族可能兩個都有，一個人的兩個都為0。
3. "Pclass" 跟 "Age" 相關係數為-0.32，為中度負相關，推測較低等級座位的成年人比較多，較高等級座位的小孩比較多。
4. "Pclass" 跟 "Survived" 相關係數為-0.34，為中度負相關，推測原因教高等級座位的人離救生船比較近，生存率較高。

In [63]:

```
data = [train, test,test_2]
for dataset in data:
    dataset['Age'] = dataset['Age'].astype(int)
    dataset.loc[ dataset['Age'] <= 11, 'Age'] = 0
    dataset.loc[(dataset['Age'] > 11) & (dataset['Age'] <= 18), 'Age'] = 1
    dataset.loc[(dataset['Age'] > 18) & (dataset['Age'] <= 22), 'Age'] = 2
    dataset.loc[(dataset['Age'] > 22) & (dataset['Age'] <= 27), 'Age'] = 3
    dataset.loc[(dataset['Age'] > 27) & (dataset['Age'] <= 33), 'Age'] = 4
    dataset.loc[(dataset['Age'] > 33) & (dataset['Age'] <= 40), 'Age'] = 5
    dataset.loc[(dataset['Age'] > 40) & (dataset['Age'] <= 66), 'Age'] = 6
    dataset.loc[ dataset['Age'] > 66, 'Age'] = 6

# let's see how it's distributed train_df['Age'].value_counts()
```

In [64]:

```
train['Age'].value_counts()
```

Out[64]:

```
4    173
6    168
5    145
3    133
2    107
1     97
0     68
Name: Age, dtype: int64
```

In [65]:

```
data = [train, test,test_2]

for dataset in data:
    dataset.loc[ dataset['Fare'] <= 7.91, 'Fare'] = 0
    dataset.loc[(dataset['Fare'] > 7.91) & (dataset['Fare'] <= 14.454), 'Fare'] = 1
    dataset.loc[(dataset['Fare'] > 14.454) & (dataset['Fare'] <= 31), 'Fare']   = 2
    dataset.loc[(dataset['Fare'] > 31) & (dataset['Fare'] <= 99), 'Fare']   = 3
    dataset.loc[(dataset['Fare'] > 99) & (dataset['Fare'] <= 250), 'Fare']   = 4
    dataset.loc[ dataset['Fare'] > 250, 'Fare'] = 5
    dataset['Fare'] = dataset['Fare'].astype(int)
```

In [66]:

```
data = [train, test,test_2]
for dataset in data:
    dataset['Age_Class']= dataset['Age']* dataset['Pclass']
```

In [67]:

```
data = [train, test,test_2]
for dataset in data:
    dataset['relatives'] = dataset['SibSp'] + dataset['Parch']
    dataset.loc[dataset['relatives'] > 0, 'not_alone'] = 0
    dataset.loc[dataset['relatives'] == 0, 'not_alone'] = 1
    dataset['not_alone'] = dataset['not_alone'].astype(int)
train['not_alone'].value_counts()
```

Out[67]:

```
1    537
0    354
Name: not_alone, dtype: int64
```

In [69]:

```
for dataset in data:
    dataset['Fare_Per_Person'] = dataset['Fare']/(dataset['relatives']+1)
    dataset['Fare_Per_Person'] = dataset['Fare_Per_Person'].astype(int)
train.head(10)
```

Out[69]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Age_Class	relatives	not_alone
0	0	3	0	2	1	0	0	0	6	1	0
1	1	1	1	5	1	0	3	1	5	1	0
2	1	3	1	3	0	0	0	0	9	0	1
3	1	1	1	5	1	0	3	0	5	1	0
4	0	3	0	5	0	0	1	0	15	0	1
5	0	3	0	4	0	0	1	2	12	0	1
6	0	1	0	6	0	0	3	0	6	0	1
7	0	3	0	0	3	1	2	0	0	4	0
8	1	3	1	3	0	2	1	0	9	2	0
9	1	2	1	1	1	0	2	1	2	1	0

In [70]:

```
X_train = train.drop("Survived", axis=1)
Y_train = train["Survived"]
X_test  = test
```

In [71]:

```
X_train.columns
```

Out[71]:

```
Index(['Pclass', 'Sex', 'Age', 'SibSp', 'Parch', 'Fare', 'Embarked',
       'Age_Class', 'relatives', 'not_alone', 'Fare_Per_Person'],
      dtype='object')
```

In [72]:

```
from sklearn.ensemble import RandomForestClassifier
random_forest = RandomForestClassifier(n_estimators=100)
random_forest.fit(X_train, Y_train)

Y_prediction = random_forest.predict(X_test)

random_forest.score(X_train, Y_train)
```

Out[72]:

```
0.9057239057239057
```

In [73]:

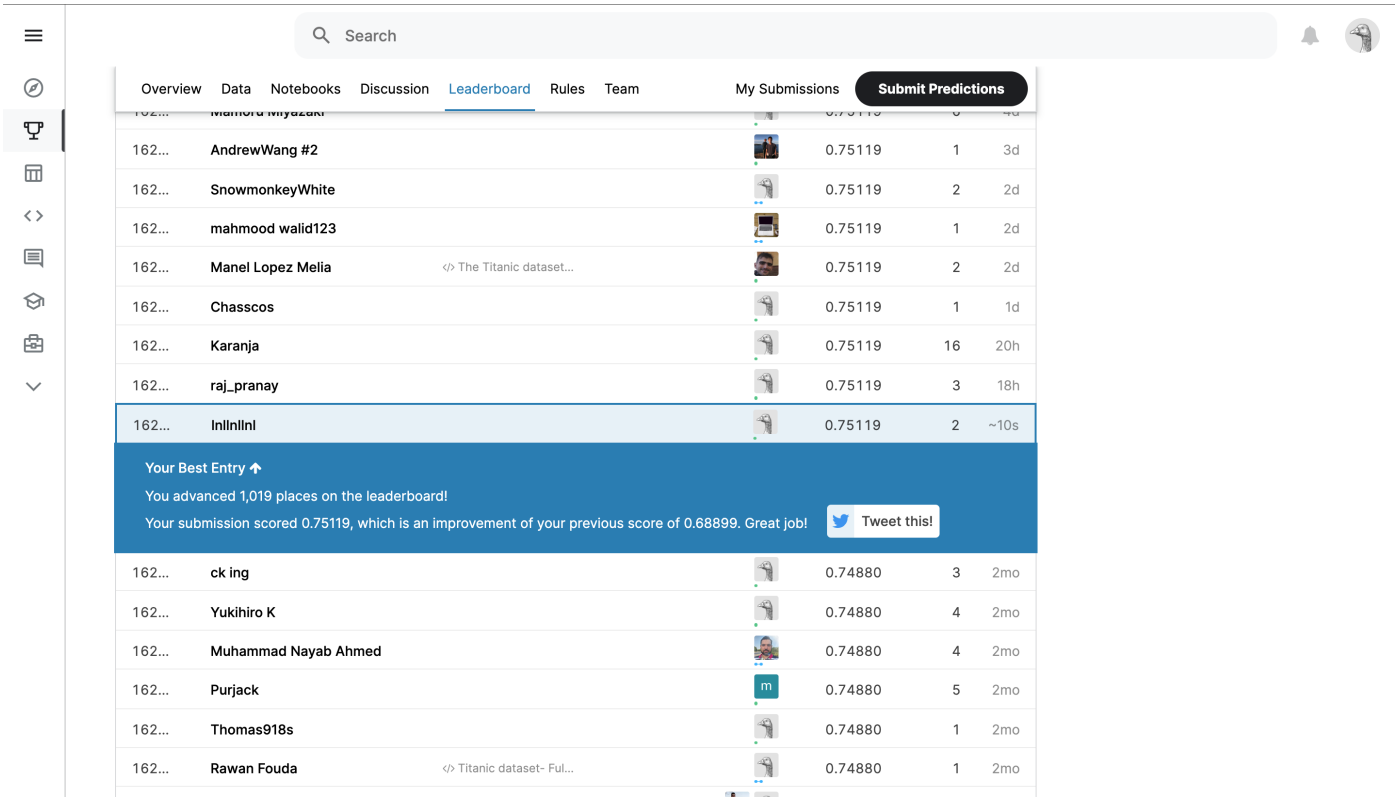
```
Y_prediction
```

Out[73]:

```
array([0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0,
0,
       1, 1, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0,
1,
       1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1,
1,
       1, 0, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1,
0,
       1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
0,
       0, 1, 1, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0,
1,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0,
0,
       0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0,
1,
       1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1,
0,
       0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1,
0,
       1, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 1,
1,
       0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1,
0,
       0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0,
0,
       0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1,
0,
       0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0,
0,
       1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1,
0,
       0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0,
0,
       1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0,
1,
       0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0,
0])
```

In [74]:

```
pred = random_forest.predict(test[X_train.columns])
submission = pd.DataFrame({
                           "PassengerId": test_2["PassengerId"],
                           "Survived": Y_prediction
                       })
submission.to_csv('submission.csv', index=False)
```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162... AndrewWang #2 0.75119 1 3d
162... SnowmonkeyWhite 0.75119 2 2d
162... mahmood walid123 0.75119 1 2d
162... Manel Lopez Melia </> The Titanic dataset... 0.75119 2 2d
162... Chasscos 0.75119 1 1d
162... Karanja 0.75119 16 20h
162... raj_pranay 0.75119 3 18h
162... lnllnllnl 0.75119 2 ~10s
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You advanced 1,019 places on the leaderboard!
Your submission scored 0.75119, which is an improvement of your previous score of 0.68899. Great job!
Tweet this!
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162... Yukihiro K 0.74880 4 2mo
162... Muhammad Nayab Ahmed 0.74880 4 2mo
162... Purjack 0.74880 5 2mo
162... Thomas918s 0.74880 1 2mo
162... Rawan Fouda </> Titanic dataset- Ful... 0.74880 1 2mo